

REMARKS

Reconsideration of the application is requested in view of the modifications above and the remarks below. Applicants attach a copy of the pending claims of this application. Applicants acknowledge the withdrawal of the rejection of Claims 6-7 and 9 under 35 USC 112. Applicants have cancelled Claims 4, 5, 6, and 9. Applicants have amended Claim 1 as indicated above.

Rejections Under 35 USC 102

1. Rejection of Claims 1 and 7-10 Under 35 USC 102 Over U.S. Pat. No. 6,264,818

The Office Action rejected Claims 1 and 7-10 under 35 USC 102 over U.S. Pat. No. 6,264,818 (Heider). The rejection should be withdrawn in view of the modifications above and the remarks below.

It is well settled that in order for a prior art reference to anticipate a claim, the reference must disclose each and every element of claim with sufficient clarity to prove its existence in prior art. The disclosure requirement under 35 USC 102 presupposes knowledge of one skilled in art of claimed invention, but such presumed knowledge does not grant license to read into prior art reference teachings that are not there. See Motorola Inc. v. Interdigital Technology Corp. 43 USPQ2d 1481 (1997 CAFC).

Applicants' invention relates to a process that prepares perfluorobutylsulfonyl fluoride from a starting material selected from the group consisting of sulfolane, sulfolene, butylsulfonyl fluoride, butylsulfonyl chloride, and mixtures thereof. The process subjects the starting material to electrochemical fluorination with an electrolyte comprising hydrogen fluoride, in which the starting material is added continuously so that the electrolyte has a quantity of charge that ranges from about 5 Ah per kg of electrolyte to about 600 Ah per kg of electrolyte. In one embodiment, the current density at which the electrolysis is carried out is from about 5 to about 40 mA/cm² and the voltage is from about 5 to about 10 volts. In another embodiment, the hydrogen fluoride used has an arsenic content of less than about

10 ppm.

Heider discloses a process for preparing perfluoroalkylfluorophosphoranes of the general formula $(C_n F_{2n+m})_y PF_{5-y}$ (I), in which n is 1, 2, 3, 4, 5, 6, 7 or 8, m is +1 or -1, and y is 1, 2 or 3, in which the ligands $(C_n F_{2n+m})$ may be identical or different, and also to their use as electrolytes and as precursors for conducting salts, and to their use in lithium batteries (See Column 1).

Heider's process for preparing perfluoroalkylfluorophosphoranes does not anticipate Applicants' process, as encompassed by Claim 1. Heider does not anticipate the other embodiments of Applicants' invention. Importantly, Heider discloses at Column 3, lines 42-44 that the „liquid reaction product is periodically withdrawn and the volume withdrawn is replaced by adding hydrogen fluoride with a new starting material.“ In other words, Heider discloses that non-fluorinated or partially fluorinated compounds are introduced non-continuously and that their process is not continuous. As such, Heider does not place Applicants' process in the possession of the public. Reconsideration is requested.

The Office Action's comments do not appreciate the differences that exist between Applicants' invention and Heider. In Heider, "continuously" refers to the electrolysis, i.e., a voltage is continuously applied to the cell, so that a current can flow. Heider does not disclose a process that continuously adds the starting material. Heider describes the discontinuous addition of starting material in which constant operating conditions of the electrolytic cell cannot be obtained since the electrolyte is changed batchwise (see column 3, lines 42 - 44). In Applicants' invention, the term "continuously" refers to the continuous addition of the starting material which is carried out in such a manner that the electrolyte can take up a quantity of charge of 5 to 600 Ah/kg. Reconsideration is requested.

2. Rejection of Claims 1, 7 and 10 Under 35 USC 102 Over DE 2,725,211 (DE '211).

The Office Action rejected Claims 1, 7 and 10 under 35 USC 102 over DE 2,725,211 (DE '211). The rejection should be withdrawn in view of the modifications

above and the remarks below.

Applicants' invention relates to a process that continuously prepares perfluorobutylsulfonyl fluoride from a starting material selected from the group consisting of sulfolane, sulfolene, butylsulfonyl fluoride, butylsulfonyl chloride, and mixtures thereof. The process subjects the starting material to electrochemical fluorination with an electrolyte comprising hydrogen fluoride, in which the starting material is added continuously so that the electrolyte has a quantity of charge that ranges from about 5 Ah per kg of electrolyte to about 600 Ah per kg of electrolyte. In one embodiment, the hydrogen fluoride used has an arsenic content of less than about 10 ppm.

DE '211 discloses the preparation of perfluoroalkanesulfonyl fluorides by electrolysis of a solution of an alkanesulfonyl halide and/or a cyclic unsaturated sulfone in practically anhydrous HF. The process involves (a) using anodes having surfaces that have been mechanically roughened and (b) using an electrode that has already been electrolysed with a quantity of electricity of more than or equal to 1 Ah per cc of electrolyte and/or which has already produced 0.05 g of (I) per cc of electrolyte. The compounds made are useful as intermediates for preparing repellants and surfactants.

DE '211's preparation of perfluoroalkanesulfonyl fluorides by electrolysis of a solution of an alkanesulfonyl halide and/or a cyclic unsaturated sulfone in practically anhydrous HF does not anticipate Applicants' process. DE 211's disclosure that its process uses (i) anodes having surfaces that have been mechanically roughened and (ii) an electrode that has already been electrolysed with a quantity of electricity of more than or equal to 1 Ah per cc of electrolyte and/or which has already produced 0.05 g of (I) per cc of electrolyte does not disclose a process that continuously prepares perfluorinated organic compounds by electrochemically fluorinating a non-fluorinated or a partially fluorinated organic compound with an electrolyte comprising hydrogen fluoride that has a quantity of charge that ranges from about 5 Ah per kg of electrolyte to about 600 Ah per kg of electrolyte (or the other embodiments encompassed by Applicants' invention). In other words, DE '211

anodes are conditioned for the electrochemical fluorination process and relate to an application that is fundamentally different from Applicants' invention. Reconsideration is requested.

The Office Action's comments about DE'211 do not appreciate the differences that exist between Applicants' invention and DE'211. DE'211 discloses the conditioning of the electrode surface. It refers to an electrolyte with a quantity of charge of 1 Ah/cm³ of electrolyte. Since hydrogen fluoride has a density of 1 g/cm³ this means that a quantity of charge of more than 1000 Ah/kg of electrolyte would have to be introduced. This is different from Applicants' invention, since the quantity of charge to be taken up by the electrolyte should be between 5 and 600, and preferably between 20 and 400 Ah/kg. In addition, the teaching of DE'211 does not state how much charge the electrolyte can take up, and no details are provided of how much starting material must be metered in. Applicants request that the U.S. P.T.O acknowledge the differences between their invention and DE'211 and withdraw the rejection.

3. Rejection of Claims 1, 4, 6-8, and 10 Under 35 USC 102 Over U.S. Pat No. 5,366,597.

The Office Action rejected Claims 1, 4, 6-8, and 10 under 35 USC 102 over U.S. Pat. No. 5,366,597 (Bulan '597). The rejection should be withdrawn in view of the modifications above and the remarks below.

Applicants' invention relates to a process that continuously prepares perfluorobutylsulfonyl fluoride from a starting material selected from the group consisting of sulfolane, sulfolene, butylsulfonyl fluoride, butylsulfonyl chloride, and mixtures thereof. The process subjects the starting material to electrochemical fluorination with an electrolyte comprising hydrogen fluoride, in which the starting material is added continuously so that the electrolyte has a quantity of charge that ranges from about 5 Ah per kg of electrolyte to about 600 Ah per kg of electrolyte. In one embodiment, the current density at which the electrolysis is carried out is from about 5 to about 40 mA/cm² and the voltage is from about 5 to about 10 volts. In

one embodiment, the hydrogen fluoride used has an arsenic content of less than about 10 ppm.

Bulan discloses a process for the preparation of perfluorobutylsulfonyl fluoride by electrochemical fluorination of butylsulfonyl fluoride, tetrahydrothiophene-1,1-dioxide (sulfolane), 2,5-dihydrothiophene-1,1-dioxide (sulfolene) or mixtures of these in hydrogen fluoride.

Bulan's process for making perfluorobutylsulfonyl fluoride by electrochemical fluorination of butylsulfonyl fluoride, tetrahydrothiophene-1,1-dioxide (sulfolane), 2,5-dihydrothiophene-1,1-dioxide (sulfolene) or mixtures of these in hydrogen fluoride would not have placed Applicants' invention in the possession of the public. In the Bulan process, the material to be fluorinated is added according to the reaction equation (cf. col. 2, lines 18-41). At the beginning of the electrochemical fluorination about 2% by weight of the material to be fluorinated is initially introduced into the hydrogen fluoride in order to prevent the formation of detonating fluorine gas at the beginning of the electrochemical fluorination process. This procedure is only carried out in the initiation step. According to the reaction equation of Bulan, as soon as the electrochemical fluorination has been initiated, the material to be fluorinated is metered into the electrolyte. Since, in electrochemical fluorination processes operated over longer periods of time, the products formed cannot be precisely determined, the quantity of material to be fluorinated in the electrolyte either decreases or increases. Bulan simply lacks the details to disclose Applicants' invention. Reconsideration is requested.

4. Rejection of Claim 11 Under 35 USC 102 Over Heider

With respect to the rejection of Claim 11 under Heider, Applicants submit that Heider does not disclose every element of Claim 11. Heider discloses a process in which the hydrogen fluoride is treated by preliminary electrolysis. Even if the conclusion could be drawn from this that a hydrogen fluoride with a reduced quantity of water is produced, there is nothing in Heider that discloses that the sulfuric acid content or arsenic content can be reduced. Reconsideration is requested.

5. Rejection of Claim 11 Under 35 USC 102 Over DE '211

The Office Action rejected Claim 11 under 35 USC 102 over DE'211. The rejection should be withdrawn.

DE' 211 does not disclose every element of Applicants' invention. DE '211 does not disclose a process that continuously prepares perfluorinated organic compounds, as claimed by Applicants. DE '211 does not disclose a process that electrochemically fluorinates a non-fluorinated or a partially fluorinated organic compounds with an electrolyte comprising hydrogen fluoride that has a quantity of charge ranging from about 5 Ah per kg of electrolyte to about 600 Ah per kg of electrolyte, in which the hydrogen fluoride has a water content of less than about 300 ppm, a sulfuric acid content of less than about 300 ppm, a sulfur dioxide content of less than about 30 ppm and an arsenic content of less than about 30 ppm.

Reconsideration is requested.

6. Rejection of Claim 11 Under 35 USC 102 Over Bulan

Similarly, Bulan does not disclose every element of Applicants' invention. Bulan does not disclose a process that continuously prepares perfluorinated organic compounds, as claimed by Applicants. Bulan does not disclose a process that electrochemically fluorinates a non-fluorinated or a partially fluorinated organic compounds with an electrolyte comprising hydrogen fluoride that has a quantity of charge ranging from about 5 Ah per kg of electrolyte to about 600 Ah per kg of electrolyte, in which the hydrogen fluoride has a water content of less than about 300 ppm, a sulfuric acid content of less than about 300 ppm, a sulfur dioxide content of less than about 30 ppm and an arsenic content of less than about 30 ppm.

Reconsideration is requested.

C. Rejections Under 35 USC 103

1. Rejection of Claims 2, 5, and 6 Under 35 USC 103 Over Heider

The Office Action rejected Claims 2, 5, and 6 under 35 USC 103 over Heider. The rejection should be withdrawn in view of the modifications above and the remarks below.

It is well-settled that to establish a *prima facie* case of obviousness, the

USPTO must satisfy all of the following requirements. First, the prior art relied upon, coupled with the knowledge generally available in the art at the time of the invention, must contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or to combine references. *In re Fine*, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). Second, the proposed modification must have had a reasonable expectation of success, as determined from the vantage point of one of ordinary skill in the art at the time the invention was made. *Amgen v. Chugai Pharmaceutical Co.* 18 USPQ 2d 1016, 1023 (Fed Cir, 1991), cert. denied 502 U.S. 856 (1991). Third, the prior art reference or combination of references must teach or suggest all of the limitations of the claims. *In re Wilson*, 165 USPQ 494, 496, (CCPA 1970). The Office Action did not establish a *prima facie* case of obviousness.

Applicants' invention relates to a process that subjects the starting material to electrochemical fluorination with an electrolyte comprising hydrogen fluoride, in which the starting material is added continuously so that the electrolyte has a quantity of charge that ranges from about 5 Ah per kg of electrolyte to about 600 Ah per kg of electrolyte. The quantity of charge is kept in the range from about 50 to about 200 Ah per kg of electrolyte.

Heider teaches a process for preparing perfluoroalkylfluorophosphoranes of the general formula $(C_n F_{2n+m})_y PF_{5-y}$ (I), in which n is 1, 2, 3, 4, 5, 6, 7 or 8, m is +1 or -1, and y is 1, 2 or 3, in which the ligands $(C_n F_{2n+m})$ may be identical or different, and also to their use as electrolytes and as precursors for conducting salts, and to their use in lithium batteries.

One of ordinary skill in the art following Heider would not have been motivated to modify Heider and practice Applicants' invention. Heider's process for preparing perfluoroalkylfluorophosphoranes of the general formula $(C_n F_{2n+m})_y PF_{5-y}$ (I), simply does not have meaningful details that would have motivated the artisan to modify Heider and practice Applicants' invention. As discussed above, Heider teaches a non-continuous process. Heider teaches that the "liquid reaction product is periodically withdrawn and the volume withdrawn is replaced by adding hydrogen fluoride with new starting material." Such teachings clearly show fundamental

differences between Applicants' invention and Heider.

Indeed, Heider teaches a mixture of hydrogen fluoride and the material to be fluorinated (the "starting material") is added batchwise to the electrolyte. This is different from the continuous procedure used in Applicant's invention.

Although an electrolyte is obtained by the process cited in Heider which, as can be calculated from Example 1, can absorb a quantity of charge of about 200 Ah/kg, the material to be fluorinated is not replaced but reacts in the form of a batch. Thus, for example, for the first quantity added of 27.8 g of a 36% solution of the material to be fluorinated (triethylphosphorane) in hydrogen fluoride, a charge of 81.8 Ah is introduced into the electrolyte, although theoretically only 68 Ah would be necessary. Only then is an additional amount (30.4 g) of material to be fluorinated added. This procedure is also used in the other examples of Heider and it differs from the process of Applicants' invention.

In Applicants' process, electrolysis is carried out continuously and the material to be fluorinated is added continuously. In industrial electrolysis processes, batch procedures corresponding to that of Heider are not possible for safety reasons, because the quantity of charge required for the complete conversion of the material to be fluorinated cannot be precisely calculated. The reason for this is that the products obtained in electrochemical fluorination processes cannot be precisely predicted and a product mixture is obtained which, depending on its composition, requires very different charges. Thus, in the batch process of Heider, 20% more charge was introduced into the electrolyte than would have been necessary according to the reaction equation. If more charge is introduced than the material to be fluorinated which is present in the electrolyte, the hydrogen fluoride is reacted to form fluorine and hydrogen, which would have caused the unit to explode. Thus, Heider cannot be used for industrial fluorination processes. Heider does not anticipate Applicants' invention. Reconsideration is requested.

2. Rejection of Claims 2, 5-6 and 8-9 Under 35 USC 103 Over DE '211

The Office Action rejected Claims 2, 5-6 and 8-9 under 35 USC 103 over DE

'211. The rejection should be withdrawn in view of the remarks below.

Applicants' invention relates to a process that subjects the starting material to electrochemical fluorination with an electrolyte comprising hydrogen fluoride, in which the starting material is added continuously so that the electrolyte has a quantity of charge that ranges from about 5 Ah per kg of electrolyte to about 600 Ah per kg of electrolyte. The quantity of charge is kept in the range from about 50 to about 200 Ah per kg of electrolyte. In one embodiment, the current density at which the electrolysis is carried out is from about 5 to about 40 mA/cm² and the voltage is from about 5 to about 10 volts.

DE '211 teaches the preparation of perfluoroalkanesulfonyl fluorides by electrolysis of a solution of an alkanesulfonyl halide and/or a cyclic unsaturated sulfone in practically anhydrous HF. The process involves (a) using anodes having surfaces that have been mechanically roughened and (b) using an electrode that has already been electrolysed with a quantity of electricity of more than or equal to 1 Ah per cc of electrolyte and/or which has already produced 0.05 g of (I) per cc of electrolyte. The compounds made are useful as intermediates for preparing repellants and surfactants.

One of ordinary skill following the teachings of DE '211 would not have been motivated to modify DE '211 and practice Applicants' invention. DE 211's teachings to a) use anodes having surfaces that have been mechanically roughened and (b) use an electrode that has already been electrolysed with a quantity of electricity of more than or equal to 1 Ah per cc of electrolyte and/or which has already produced 0.05 g of (I) per cc of electrolyte simply does not meaningful details that would have led one of ordinary skill in the art to Applicants' invention. Reconsideration is requested.

3. Rejection of Claims 2, 5-6 and 8-9 Under 35 USC 103 Over Bulan

The Office Action rejected Claims 2, 5-6 and 8-9 under 35 USC 103 over Bulan.

Applicants' invention relates to a process that continuously prepares perfluorobutylsulfonyl fluoride from a starting material selected from the group

consisting of sulfolane, sulfolene, butylsulfonyl fluoride, butylsulfonyl chloride, and mixtures thereof. The process subjects the starting material to electrochemical fluorination with an electrolyte comprising hydrogen fluoride, in which the starting material is added continuously so that the electrolyte has a quantity of charge that ranges from about 5 Ah per kg of electrolyte to about 600 Ah per kg of electrolyte. The quantity of charge is kept in the range from about 50 to about 200 Ah per kg of electrolyte. In one embodiment, the current density at which the electrolysis is carried out is from about 5 to about 40 mA/cm² and the voltage is from about 5 to about 10 volts.

Bulan teaches a process for the preparation of perfluorobutylsulfonyl fluoride by electrochemical fluorination of butylsulfonyl fluoride, tetrahydrothiophene-1,1-dioxide (sulfolane), 2,5-dihydrothiophene-1,1-dioxide (sulfolene) or mixtures of these in hydrogen fluoride. Bulan's process for preparing perfluorobutylsulfonyl fluoride by electrochemical fluorination of butylsulfonyl fluoride, tetrahydrothiophene-1,1-dioxide (sulfolane), 2,5-dihydrothiophene-1,1-dioxide (sulfolene) or mixtures of these in hydrogen fluoride would not have motivated one of ordinary skill in the art to modify Bulan and practice Applicants' invention.

Bulan's process for making perfluorobutylsulfonyl fluoride by electrochemical fluorination of butylsulfonyl fluoride, tetrahydrothiophene-1,1-dioxide (sulfolane), 2,5-dihydrothiophene-1,1-dioxide (sulfolene) or mixtures of these in hydrogen fluoride does not place Applicants' invention in the possession of the public. In the Bulan process, the material to be fluorinated is added according to the reaction equation (cf. col. 2, lines 18-41). At the beginning of the electrochemical fluorination about 2% by weight of the material to be fluorinated is initially introduced into the hydrogen fluoride in order to prevent the formation of detonating fluorine gas at the beginning of the electrochemical fluorination process. This procedure is only carried out in the initiation step. According to the reaction equation of Bulan, as soon as the electrochemical fluorination has been initiated, the material to be fluorinated is metered into the electrolyte. Since, in electrochemical fluorination processes operated over longer periods of time, the products formed cannot be precisely

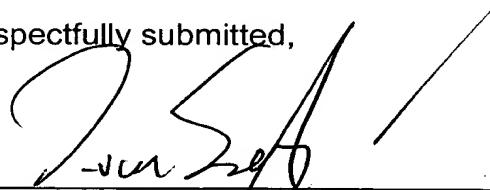
determined, the quantity of material to be fluorinated in the electrolyte either decreases or increases. Bulan simply lacks the details to disclose a process for the continuous preparation of perfluorinated organic compounds comprising electrochemically fluorinating a non-fluorinated or a partially fluorinated organic compound with an electrolyte comprising hydrogen fluoride that has a quantity of charge that ranges from about 5 Ah per kg of electrolyte to about 600 Ah per kg of electrolyte. Reconsideration is requested.

In summary, neither Heider, nor DE '211, nor Bulan disclose each and every element of the claims rejected under 35 USC 102 with sufficient clarity to prove Applicants' invention existed in the prior art. With respect to the rejections under 35 USC 103, the Office Action did not establish a *prima facie* case of obviousness. Neither Heider, nor DE '211, nor Bulan, singly or in combination, coupled with the knowledge generally available in the art at the time of the invention, contains some suggestion or incentive that would have motivated the skilled artisan to modify a reference or to combine references and practice Applicants' process. The modification alleged by the Office Action does not have a reasonable expectation of success, as determined from the vantage point of one of ordinary skill in the art at the time the invention was made. Neither Heider, nor DE '211, nor Bulan, singly or in combination, teach or suggest all of the limitations of the claims rejected under 35 USC 103.

In view of the foregoing modifications and remarks, the allowance of the pending claims is earnestly requested.

Respectfully submitted,

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